

The 1953 mass chest X-ray survey in Pittsburgh and Allegheny County, Pa., accurately identified an estimated 40 cases of primary lung cancer in about 802,000 residents examined.

Followup Study of 844 Neoplasm Suspects Identified in a Mass Chest X-ray Survey

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STATISTICAL and clinical studies of the effectiveness of mass chest X-ray surveys in finding primary lung cancer have been reported since 1950 (1-6). Because of continued and rather widespread interest in this subject, the results of a similar study carried out as part of the followup of the 1953 mass chest X-ray survey in Pittsburgh and Allegheny County, Pa., are recorded here. In this study, 844 persons classified on the basis of survey films as neoplasm suspects were followed for 30 months to determine their clinical diagnoses and mortality experience.

As stated by the Pittsburgh and Allegheny County X-ray Survey Foundation, the primary purpose of the survey was to screen the adult population (over 15 years of age) of Pittsburgh and Allegheny County for undiagnosed active

tuberculosis. An important secondary purpose was to screen the group for other active chest diseases, including neoplasms.

Survey Procedures

All persons participating in the survey initially had 70-mm. postero-anterior chest films. These were read for abnormalities by at least 1 member of a team of 4 Public Health Service physicians. Participants whose films were considered negative were so notified by mail. Resident participants whose films were technically unsatisfactory or showed abnormal findings were requested to report to survey headquarters for confirmatory films.

On return for a confirmatory film, the participant was interviewed by a clerk, and basic

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Dr. C. Howard Marcy, secretary of the Pittsburgh and Allegheny County X-ray Survey Foundation, and Dr. Robert Anderson, at the time of the study, chief of the Tuberculosis Control Division, Public

Health Service, made available the original survey records. Dr. Merle Bundy, then director of tuberculosis control, Pittsburgh Department of Public Health, and secretary, Allegheny County Chapter, American Cancer Society, assisted in the study planning.

Dr. Mary E. Patno, office of biostatistics, Pittsburgh Department of Public Health, tabulated the general survey data. J. William Lloyd of the same office made the special tabulations of the neoplasm suspects. Miss Bernadette Brady of the Public Health Service assisted with the special followup of the neoplasm suspects.

data, including the name of the participant's private physician, were recorded on an epidemiology worksheet. All persons responding to recall who were suspected on the basis of the original 70-mm. film of having tuberculosis, neoplasms, or "other chest disease" routinely had 14" x 17" postero-anterior confirmatory films. Lateral or oblique views were filmed whenever the film interpreter requested them. All persons suspected of having cardiovascular disease had 70-mm. confirmatory films.

Four main categories of chest disease suspects were referred to their private physicians on the basis of the confirmatory film or, if the participant failed to respond to recall, on the basis of medical review of the original 70-mm. film. Nonrespondents were referred only when their 70-mm. films were regarded by the medical review committee as warranting further clinical study. For these cases, the basic epidemiological data were gathered through telephone calls or visits by nurses to the participants. Each referral was accompanied by the partially completed epidemiology worksheet. The physician was requested to add to this the final diagnosis of the patient's chest condition when it had been determined and to return the form to survey headquarters as soon as possible. If the private physician referred the patient to another physician for diagnosis, a duplicate epidemiology form was sent to the new physician with the same request.

The epidemiology forms provided most of the data upon which the clinical findings reported in the following section are based. However, additional followup procedures, including telephone calls and special letters to the physicians, were employed by the survey personnel and the local unit of the American Cancer Society to determine clinical diagnoses for the 784 neoplasm suspects who were referred. Of the 844 neoplasm suspects included in this study, 60 were not referred because they could not be located, had died, or were uncooperative.

General Survey Results

The total number of persons X-rayed in the survey was 864,790, which represents approximately 75 percent of the total population of Allegheny County eligible for participation. However, that figure includes many visitors to the county and a few persons who were X-rayed more than once. At present, the best estimate of the number of visitors and multiple films is approximately 62,759, which leaves a total of 802,031 residents X-rayed. This estimate is based on the percentage of visitors and multiple films noted in the recall population.

Because of the size of the task, the age-sex rates of participation have not yet been determined. Thompson and Pell, however, have estimated the age-sex participation rates for approximately 80,000 residents of the Arsenal

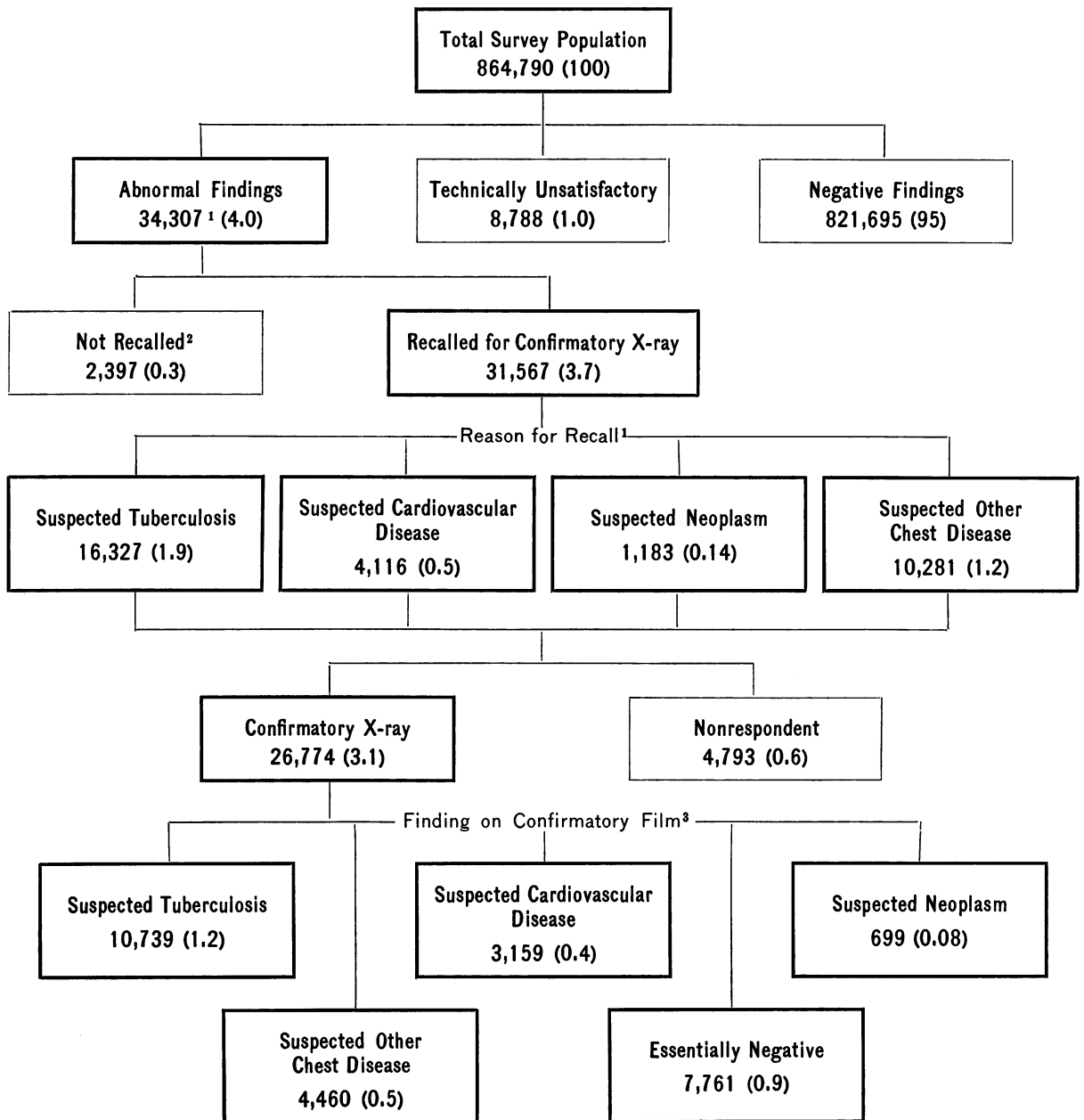
Table 1. Estimated resident participation in the 1953 mass chest X-ray survey in Pittsburgh and Allegheny County, Pa., by age and sex

Age group (years)	Males		Females		Total participants
	Percent participation ¹	Number participants ²	Percent participation ¹	Number participants ²	
15-24.....	48. 6	50, 585	57. 5	67, 212	117, 797
25-34.....	57. 0	72, 123	58. 4	80, 980	153, 103
35-44.....	66. 9	77, 293	61. 0	73, 880	151, 175
45-54.....	64. 4	60, 737	67. 9	64, 871	125, 608
55-64.....	57. 2	43, 727	56. 8	41, 456	85, 183
65-74.....	53. 4	22, 733	47. 3	20, 733	43, 466
75 and over.....	34. 7	5, 389	25. 0	4, 868	10, 257
Total.....	58. 6	332, 587	58. 6	354, 000	686, 587

¹ Weighted averages for combined age groups of Arsenal health district sample (7).

² Obtained by applying participation rates to population of Allegheny County in 1953, as estimated by applying age-sex percentage distribution in 1950 to estimated 1953 population.

Results of the Mass Chest X-ray Survey in Pittsburgh and Allegheny County, Pa., March 25–September 25, 1953



¹Based on interpretation of original 70-mm. films (including 343 duplicates, triplicates, etc.).

²Residence outside survey area.

³Based on interpretation of confirmatory 14" x 17" or 70-mm. films (including 44 large films taken on persons other than those recalled).

NOTE: Figures in parentheses are percentages based on total survey population.

health district in Pittsburgh (7). By applying these rates to the estimated age-sex distribution for the 1953 population of Allegheny County, the number of residents X-rayed in each age-sex group can be calculated, as shown in table 1. According to this method, the total number of resident participants was 686,587, considerably fewer than the number found by subtracting the estimated number of visitors and multiple films. However, Thompson and Pell have stated that they felt the participation

rates in the Arsenal health district were lower than those for many other sections of the city and county.

X-ray Findings

As shown in the accompanying diagram, 4 percent of the total survey population were considered to have abnormal X-ray findings on the basis of the original 70-mm. films. Of these, 31,567 (all those with abnormal findings who were residents of the county) were recalled for

Table 2. Clinical diagnoses reported during survey followup period (April 10, 1953–June 30, 1954), according to type of disease suspected at time of referral: 1953 mass chest X-ray survey in Pittsburgh and Allegheny County, Pa.

Disease suspected at time of referral	Number persons referred	Clinical diagnosis reported after referral						No report of clinical findings
		Tuber- culosis	Cardio- vascular disease	Neo- plasm	Other chest disease	Negative	Total	
Tuberculosis.....	10, 315	4, 595	71	28	667	825	6, 186	4, 129
Cardiovascular disease.....	3, 256	2	1, 397	2	15	61	1, 477	1, 779
Neoplasm.....	784	107	25	180	245	56	613	171
Other chest disease.....	4, 775	224	186	60	1, 558	389	2, 417	2, 358
Total.....	19, 130	4, 928	1, 679	270	2, 485	1, 331	10, 693	8, 437

Table 3. Clinical diagnoses¹ for 844 neoplasm suspects identified in the 1953 mass chest X-ray survey in Pittsburgh and Allegheny County, Pa., according to site of tumor suspected at time of referral

Suspected tumor site	Total persons in category		Clinical diagnosis reported after referral																		No report of clinical findings ²			
			Primary malignancy						Meta-static malignancy to thoracic organs	Benign neoplasm		Total chest neoplasm		Tuberculosis, pulmonary		Cardio-vascular disease		Other chest disease		Negative				
			Lung		Mediastinum		Other site																	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent		
Lung-----	525	100	40	7.6	1	0.2	10	1.9	24	4.6	50	9.5	125	23.8	121	23.0	14	2.7	125	23.8	57	10.9	83	15.8
Mediastinum-----	270	100	6	2.2	14	5.2	1	.4	1	.4	165	61.1	187	69.3	5	1.9	17	6.3	23	8.5	8	3.0	30	11.1
Bone-----	42	100	0	0	0	0	2	4.8	2	4.8	15	35.7	19	45.2	1	2.4	1	2.4	6	14.3	4	9.5	11	26.2
Other-----	7	100	0	0	0	0	1	14.3	0	0	3	42.9	4	57.1	0	0	0	0	1	14.3	1	14.3	1	14.3
Total---	844	100	46	5.5	15	1.8	14	1.7	27	3.2	233	27.6	335	39.7	127	15.0	32	3.8	155	18.4	70	8.3	125	14.8

¹ Includes clinical findings obtained from hospital and office records and death certificates as well as those reported to survey headquarters.

² Includes 60 persons not referred to physicians for clinical diagnosis.

Table 4. Mortality experience of 844 neoplasm suspects identified in the mass chest X-ray survey in Pittsburgh and Allegheny County, Pa., according to clinical diagnosis after referral

Clinical diagnosis	Number persons in category	Dead						Alive end of 30 months		Status unknown end of 30 months	
		First report period ¹		Second report period ²		30-month total					
		Number	Average annual mortality (percent)	Number	Average annual mortality (percent)	Number	Percent	Number	Percent	Number	Percent
Chest neoplasm.....	335	58	17. 3	18	5. 4	76	22. 7	203	60. 6	56	16. 7
Primary malignancy:											
Lung.....	46	28	60. 9	3	11. 1	31	67. 4	12	26. 1	3	6. 5
Mediastinum.....	15	2	13. 3	0	0	2	13. 3	9	60. 0	4	26. 7
Other site.....	14	3	21. 4	3	18. 2	6	42. 9	6	42. 9	2	14. 3
Metastatic malignancy to thoracic organs.....	27	11	40. 7	2	8. 3	13	48. 1	10	37. 0	4	14. 8
Benign neoplasm.....	233	14	6. 0	10	3. 0	24	10. 3	166	71. 2	43	18. 5
Tuberculosis.....	127	3	2. 4	4	2. 2	7	5. 5	100	78. 7	20	15. 7
Cardiovascular disease.....	32	4	12. 5	3	7. 1	7	21. 9	20	62. 5	5	15. 6
Other chest disease.....	155	7	4. 5	7	3. 2	14	9. 0	112	72. 3	29	18. 7
Negative.....	70	2	2. 9	1	1. 0	3	4. 3	51	72. 9	16	22. 9
No report of clinical findings.....	125	9	7. 2	10	5. 9	19	15. 2	79	63. 2	27	21. 6
Total.....	844	83	9. 8	43	3. 8	126	14. 9	565	66. 9	153	18. 1

¹ October 1953 through September 1954.

² October 1954 through March 1956.

confirmatory films. Of those recalled, 26,774 (84.8 percent of recall population) responded.

Of the total original 70-mm. films, 16,327 (1.9 percent) were interpreted by the reader as suspected tuberculosis. Similarly, 4,116 (0.5 percent) were classified as suspected cardiovascular disease; 1,183 (0.14 percent) as suspected neoplasm; and 10,281 (1.2 percent) as suspected other chest disease. On the basis of the confirmatory films, the yield of suspected tuberculosis was reduced to 10,739, or 1.2 percent of the total survey population. Likewise, the yield of suspected cardiovascular disease was reduced to 3,159 (0.4 percent); the yield of suspected neoplasm to 699 (0.08 percent); and the yield of suspected other chest disease to 4,460 (0.5 percent). Interestingly, 7,761 participants, 0.9 percent of the total survey population, originally had X-ray findings classified as abnormal but were considered "essentially negative" after their confirmatory X-rays.

Clinical Diagnoses Reported

A total of 19,130 persons were referred to their private physicians for diagnosis (table 2). These include, in addition to those who had ab-

normal findings on the confirmatory film, some persons who were referred on the basis of their original small X-rays. During the survey followup period, April 10, 1953-June 30, 1954, clinical diagnoses were reported to survey headquarters for 10,693, or 55.9 percent, of those referred. No report of clinical findings was received for the remaining 8,437 persons referred.

The most common diagnosis reported was tuberculosis (all stages, including inactive cases), which was returned for 4,928 persons (46.1 percent). A diagnosis of cardiovascular disease was reported for 1,679 persons (15.7 percent); a diagnosis of neoplasm for 270 (2.5 percent); and a diagnosis of "other chest disease" for 2,485 (23.2 percent). A clinical impression of essentially negative was reported for 1,331 persons. This figure represents 12.4 percent of those for whom clinical diagnoses were received and 7.0 percent of the 19,130 referrals.

Study of Neoplasm Suspects

For the 844 persons identified in the survey as neoplasm suspects, a Public Health Service research team undertook special followup pro-

cedures, including abstracting of hospital and office records, examination of death certificates, and search of county death lists. By these procedures, clinical diagnoses were obtained for an additional 106 of the neoplasm suspects, and new diagnoses were found for a number of the 613 suspects for whom clinical findings had been reported during the survey followup period.

Clinical Diagnoses

The most frequent diagnosis for the neoplasm suspects was some type of neoplasm, as shown in table 3. (This table includes the clinical findings obtained by the special followup procedures; therefore, the data differ from those in table 2.) Most of the neoplasms, however, were benign chest tumors. Only 75 (8.9 percent) of all the neoplasm suspects were reported to have primary malignancies of the chest, and only 46 (5.5 percent) had diagnoses of primary lung cancer. Other yields for the neoplasm

suspects included 127 (15.0 percent) cases of tuberculosis, 32 (3.8 percent) cases of cardiovascular disease, and 155 (18.4 percent) cases of "other chest disease." For 70 (8.3 percent) of the neoplasm suspects, the diagnosis was "essentially negative." No report of clinical findings was obtained for 125 (which includes the 60 who were not referred to physicians), or 14.8 percent of the suspects.

Mortality Experience

The survival status at the end of two report periods was determined for each category of clinical diagnosis (table 4). The first report period covers the first year following the end of the X-ray survey, that is, from October 1953 through September 1954. The second report period includes the 18 months from October 1954 through March 1956. Efforts to obtain survival data on the 153 persons classified as "status unknown" have been prolonged because

Table 5. Cause of death for 126 neoplasm suspects who died during the 30 months following the 1953 mass chest X-ray survey in Pittsburgh and Allegheny County, Pa., according to clinical diagnosis after referral

Clinical diagnosis	Number persons in category	Cause of death												Total	
		Lung cancer				Other cancer				Other or unknown cause					
		1953 ¹	1954	1955-56 ²	30-month mortal- ity (percent)	1953 ¹	1954	1955-56 ²	30-month mortal- ity (percent)	1953 ¹	1954	1955-56 ²	30-month mortal- ity (percent)	Number deaths	30-month mortal- ity (percent)
Chest neoplasm-----	335	17	14	6	11.0	12	4	6	6.6	4	8	5	5.1	76	22.7
Primary malignancy:															
Lung-----	46	17	10	2	63.0	0	0	0	0	0	1	1	4.3	31	67.4
Mediastinum-----	15	0	0	0	0	1	0	0	6.7	0	1	0	6.7	2	13.3
Other site-----	14	0	1	1	14.3	1	1	2	28.6	0	0	0	0	6	42.9
Metastatic malignancy to thoracic organs-----	27	0	0	0	0	8	2	2	44.4	1	0	0	3.7	13	48.1
Benign neoplasm-----	233	0	3	3	2.6	2	1	2	2.1	3	6	4	5.6	24	10.3
Tuberculosis-----	127	0	0	0	0	0	0	0	0	2	2	3	5.5	7	5.5
Cardiovascular disease-----	32	0	0	0	0	0	1	0	3.1	2	1	3	18.8	7	21.9
Other chest disease-----	155	0	2	2	2.6	1	1	1	1.9	0	4	3	4.5	14	9.0
Negative-----	70	0	0	1	1.4	0	0	0	0	2	0	0	2.9	3	4.3
No report of clinical find- ings-----	125	1	1	0	1.6	2	3	2	4.8	2	2	6	8.8	19	15.2
Total-----	844	18	17	9	5.2	15	9	9	3.9	12	17	20	5.8	126	14.9

¹ Deaths during last 3 months of 1953.

² Deaths during 1955 and first 3 months of 1956.

Table 6. Cause of death for 126 neoplasm suspects who died during the 30 months following the 1953 mass chest X-ray survey in Pittsburgh and Allegheny County, Pa., according to site of tumor suspected at time of referral

Suspected tumor site	Number persons in category	Cause of death												Total	
		Lung cancer				Other cancer				Other or unknown cause				Number deaths	30-month mortality (percent)
		1953 ¹	1954	1955-56 ²	30-month mortality (percent)	1953 ¹	1954	1955-56 ²	30-month mortality (percent)	1953 ¹	1954	1955-56 ²	30-month mortality (percent)		
Lung-----	525	17	13	9	7.4	11	6	6	4.4	6	7	11	4.6	86	16.4
Mediastinum-----	270	1	4	0	1.9	3	2	2	2.6	5	7	9	7.8	33	12.2
Bone-----	42	0	0	0	0	1	1	1	7.1	1	3	0	9.5	7	16.7
Other-----	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total-----	844	18	17	9	5.2	15	9	9	3.9	12	17	20	5.8	126	14.9

¹ Deaths during last 3 months of 1953.

² Deaths during 1955 and first 3 months of 1956.

the majority of these moved within Allegheny County during the 30-month period; however, none appeared on the county death lists for that period.

A total of 126 deaths are known to have occurred among the neoplasm suspects during the 30-month followup period. This number is considered the minimum 30-month mortality estimate for the group since it is unlikely that all deaths were identified in this followup study. Eighty-three of the deaths occurred by the end of September 1954, giving an average annual mortality of 9.8 percent. Among the 46 persons reported to have primary lung cancer, there were 28 deaths (60.9 percent) during that period. The mortality among the non-lung-cancer patients was only 6.9 percent. The average annual mortality for all categories decreased during the second report period. The 30-month mortality figures show the highest rate for lung cancer patients.

Of the 126 known deaths during the 30-month followup period, 44 were due to lung cancer (tables 5 and 6). Cancers of other sites were the causes of 33 additional deaths, while the remaining 49 deaths were ascribed to causes other than cancer or to unknown causes. Thus, the minimum 30-month mortality among the neoplasm suspects by cause of death was 5.2 percent for lung cancer, 3.9 percent for cancers of

other sites, and 5.8 percent for all other or unknown causes. Most of the lung cancer deaths (79.5 percent) occurred by the end of 1954. Non-lung-cancer deaths, however, were more evenly distributed over the 30-month followup period.

The 30-month lung cancer mortality rate was highest (63.0 percent) among those cases diagnosed as primary lung cancer (table 5). However, 10 of the 388 persons with clinical diagnoses of either benign neoplasm or "other chest disease" also died of lung cancer during this period. Similarly, most of the lung cancer deaths (88.4 percent) occurred among those who were suspected of having lung tumors at the time of referral (table 6). The 30-month lung cancer mortality for this group was 7.4 percent. The group suspected of having lung tumors had a 30-month mortality rate for all causes of death of 16.4 percent.

Discussion

The crude yields of abnormal films, of suspected tuberculosis, and of suspected neoplasm from the survey of Pittsburgh and Allegheny County are commensurate with confirmatory findings reported for other mass chest X-ray surveys (1-5). For all categories of disease, there were wide variations between the readings

of the small and the large X-ray films. Such variations have been noted repeatedly by radiologists, and it has been assumed that the larger films can be interpreted more accurately for all types of chest disease. Thus, the reasons for taking large confirmatory X-rays in mass surveys are to reduce the number of false positives and to decrease the amount of unnecessary survey case followup. Whether or not large films are better than 70-mm. films from the standpoint of detecting neoplasms has apparently not been investigated, and the data presented here are not satisfactory for answering that question.

If the figures in table 1 represent even roughly the age-sex distribution of the survey participants, only 40 percent of the total X-rays of men were taken among those 45 years of age or older. Also, it is in the older age groups that the participation rate declines to less than 55 percent. Since a significant number of cases of primary lung cancer would be expected only among men over 45 years old, the effectiveness of the X-ray survey in finding cases of this disease was severely limited.

The clinical data presented are based largely upon the findings reported by physicians in response to the survey followup procedures. As such, these data are subject to many of the same biases recognized and reported for previous mass X-ray surveys. It is significant that by June 30, 1954, at least 10 months after all referrals were made, clinical diagnoses were reported for only 55.9 percent of the total number of persons referred. By this same date, clinical diagnoses were established for 78.2 percent of the neoplasm suspects. This higher percentage undoubtedly is due to the additional followup efforts made for this group. As a result of the special followup by a Public Health Service team, diagnoses were obtained for an additional 106 of the neoplasm suspects, bringing the percentage up to 91.5.

The yield of 5.5 percent for primary lung cancer among the neoplasm suspects is small in comparison with the yields for other diagnoses (table 3). This yield increases but slightly, to 7.6 percent, when only those persons suspected of having lung tumors are considered. The difficulty of accurately discriminating on X-ray between lung tumors, tuberculosis, and other lung diseases is reflected by the fact that among

the lung tumor suspects the percentage with clinical diagnoses of lung tumor was no greater than the percentage with clinical diagnoses of tuberculosis or "other chest disease." Accurate appraisal of any differences among these lung disease categories is obscured by the fact that different diagnostic criteria were undoubtedly applied by the many physicians reporting clinical findings. For several persons, the clinical diagnoses reported to survey headquarters had to be changed in the light of later findings noted by the physicians.

The mortality experience of the neoplasm suspects shows clearly the rapidly fatal course for the majority of the reported primary lung cancer cases (table 4). Twenty-eight of the forty-six persons with primary lung cancer died within 12 months after the end of the survey, and 31, within 30 months. Some question might be raised as to the accuracy of the diagnosis for the 15 survivors. For 8 of these, the diagnosis was confirmed microscopically, and the patients had pneumonectomies with apparently curative results. For the remaining 7 the diagnosis was based on X-rays alone.

The mortality rates were considerably higher for persons reported to have either primary or metastatic malignancies of the lungs than for those in the other diagnostic categories (table 4). Also, the majority of the deaths in the groups with malignancies occurred much earlier than the deaths in the other diagnostic groups. This observed early mortality suggests that many of the reported primary and metastatic lung cancer cases were brought to medical attention by the survey at a late stage of the disease. It is likely that extreme pathological changes were present at the time of the survey X-ray; consequently, the mortality rate was high. Deaths due to causes other than cancer occurred more frequently among persons in the non-lung-cancer diagnostic groups. This is probably due to the rapidly fatal course of both primary and metastatic lung cancers after diagnosis.

Deaths due to primary lung cancer occurred among persons in some of the other diagnostic categories; for example, the benign neoplasm and the "other chest disease" groups (table 5). These deaths, however, occurred somewhat later

than those in the lung cancer diagnostic category. For all persons in these other diagnostic groups who died of lung cancer, the lesions present at the time of the survey X-ray appeared to be small. For some of them, the absence of specific symptoms delayed a definitive diagnostic workup until the lesion had become inoperable. In this survey, the difficulty of clinically distinguishing between neoplasms, tuberculosis, or other chest disease appeared to be most accentuated when the X-ray revealed small or rather poorly defined lesions in the lungs.

Each of the 8 surviving lung cancer patients who had pneumonectomies had an opacity measuring 3 cm. or more on the 14" x 17" survey X-ray. All other diagnostic aids employed, including cytological examination of sputum and bronchial washings, were negative for each of these patients. Only at thoracotomy was a definitive diagnosis established.

The 30-month mortality experience of the neoplasm suspects according to the site suspected at the time of referral further demonstrates the difficulty of finding salvageable lung cancer cases (table 6). The distribution of the 126 known deaths shows a high mortality from lung cancer among those persons originally suspected of having lung tumors. In fact, the group suspected of having lung tumors had rather high mortality from all causes of death. However, the deaths from cancer began to occur earlier than did the deaths from other causes.

The relatively high lung cancer mortality among the lung tumor suspects, together with the fact that 7 of the 8 patients who had pneumonectomies belonged to the lung tumor suspect group, indicates that the X-ray methods employed in the survey to find cases of primary lung cancer were of limited but definite effectiveness. Had there been greater survey participation by older men, it is very probable that the ratio of primary lung cancer cases to lung tumor suspects would have been greater.

Summary

A mass chest X-ray survey was undertaken in 1953 in Pittsburgh and Allegheny County, Pa., primarily to find undiagnosed active tuberculosis and secondarily to detect other chest diseases. According to the estimated age-sex

distribution of the survey participants, participation by older men was relatively poor. Thus, the effectiveness of the survey for detecting primary lung cancer was severely limited.

Of about 802,000 resident participants, 844 were classified as neoplasm suspects on the basis of 14" x 17" confirmatory films or 70-mm. original films. By the use of the usual followup procedures plus special measures, clinical diagnoses were obtained for 91.5 percent of the 784 neoplasm suspects referred to private physicians, and the mortality experience during a 30-month period was learned for 81.9 percent of the 844.

In both the group with clinical diagnoses of primary lung cancer and the group suspected on the basis of the X-rays of having lung tumors, the mortality rate was high and death occurred in a short time. These findings demonstrate the rapidly fatal course of lung cancer following detection by X-ray or clinical diagnosis. Eight of the fifteen survivors in the lung cancer diagnostic category had pneumonectomies. For each of these eight, the survey X-ray showed rather large lesions which ordinarily would not be considered "early," but apparently the malignant process was amenable to surgery.

Deaths due to primary lung cancer also occurred among persons with clinical diagnoses of benign neoplasm or "other chest disease." These deaths occurred somewhat later than the lung cancer deaths in the lung cancer diagnostic group. For most of these persons, the presumably misdiagnosed X-ray lesions appeared small or not well defined. The difficulty of distinguishing on an X-ray film between lung tumors, tuberculosis, and "other chest disease" is indicated by the fact that among the persons suspected of having lung tumors, the percentage with clinical diagnoses of chest neoplasm was no greater than the percentages with clinical diagnoses of tuberculosis or "other chest disease." However, the comparability of the clinical findings is difficult to evaluate because of the probably different diagnostic criteria used by the physicians examining the patients.

According to information available thus far, the mass X-ray survey accurately detected an estimated 40 cases of primary lung cancer

among the participating residents of Pittsburgh and Allegheny County. Just how efficiently this was done cannot be answered from the data presented here, but certain deficiencies in the methods employed are evident.

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Syphilis Serology Courses

Nine laboratory refresher courses will be offered at the Venereal Disease Research Laboratory of the Public Health Service in Chamblee, Ga., September 1957 through May 1958, according to the following schedule:

Serology of syphilis: September 9-20, 1957; December 2-13, 1957; February 17-27, 1958; May 5-16, 1958.

Tests for syphilis using *Treponema pallidum*: October 7-18, 1957; March 10-21, 1958.

Control of syphilis serology by the regional laboratory: October 21-November 1, 1957; April 7-18, 1958.

The public health laboratory in venereal disease control: March 24-28, 1958.

The four courses in serology of syphilis consist of lecture, demonstration, and participation periods covering the most widely used procedures outlined in the 1955 edition of the *Manual of Serologic Tests for Syphilis*.

The two courses in *Treponema pallidum* tests for syphilis include instruction in the performance of the *T. pallidum* immobilization and complement fixation tests and other procedures.

Two courses in control of syphilis serology by the regional laboratory are designed for assistant laboratory directors and senior laboratory staff members. They include review of serologic evaluation programs, laboratory visits and field "workshop" procedures, and discussion of new methods using treponemal antigens.

The course on the public health laboratory in venereal disease control, designed for laboratory directors, includes discussion and demonstration of new procedures and use of laboratory aids in diagnosing venereal diseases.

Applications for the courses must be approved by the State health officer or laboratory director, by the medical officer in charge if the applicant is a Federal employee, or by the sponsoring organization of applicants from other countries. Reservations should be made not later than 1 month before the starting date of the course. Application forms may be obtained by writing to: Director, Venereal Disease Research Laboratory, Venereal Disease Branch, Communicable Disease Center, Public Health Service, P. O. Box 185, Chamblee, Ga.